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How Gender Affirming Care Affects the Current Sex Estimation Standards in Forensic Anthropology: A Preliminary Study

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HOW GENDER AFFIRMING CARE AFFECTS THE CURRENT SEX ESTIMATION STANDARDS IN FORENSIC ANTHROPOLOGY: A PRELIMINARY STUDY

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Current sex estimation standards in forensic anthropology are based on individuals whose gender matches their biological/osteological sex, also known as Cisgendered individuals. Recently, transgender individuals have started to become more common in the forensic context due to the increase in hate crimes and violence. This research builds upon past research done on how facial feminization surgery can affect both visual and metric methods, where it was found that forensic anthropologists should rely on the visual methods if they suspect someone to be transgender due to it being more accurate and being able to clearly state the scars left on the bone in reports (Schall et al. 2020). This research will use those findings to now focus more on hormone replacement therapy (HRT) since this is used for both male-to-female and female-to-male transitions. I hypothesize that the individual's bone density will be affected by the hormones introduced in HRT (estrogen or testosterone) and that the effect on bone is dependent on the time an individual has been in treatment. These differences can also be affected by whether the individual started the hormones before or after puberty. The methods for this research project are to reach out to local hospitals and gender affirming care clinics for scans, CT (Computed Tomography), MRI (Magnetic Resonance Imaging), etc. of

individuals before and after they started hormones to determine if there is any visual change or overall change in bone density. Then a survey will go out to the transgender community on the University of Nebraska-Lincoln's campus to ask their opinions on how far they are likely to go with surgeries/care, how long into their transition they plan to get or got that care, if they participated in HRT how long did it take for them to see results, and what was that process like for them. This will help ensure that members of the LGBTQ+ community who are victims of crime are identified and have an equal voice (through the study of their skeletal remains) in reconstructions of the circumstances of their death.

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Chapter 1: Introduction/Past Research/Background

Current sex estimation standards in forensic anthropology are based on individuals whose gender matches their biological/osteological sex, also known as Cisgendered individuals. Recently, transgender individuals have started to become more common in the forensic context due to the increase in hate crimes and violence that are committed against them. This research builds upon past research done on how facial feminization surgery can affect both visual and metric methods, where it was found that forensic anthropologists should rely on the visual methods if they suspect someone to be transgender due to it being more accurate and being able to clearly state the scars left on the bone in reports (Schall et al. 2020). This research will use those findings to now focus more on hormone replacement therapy (HRT) since this is used for both male-to-female and female-to-male transitions.

I hypothesize that the individual's bone density will be affected by the hormones introduced in HRT (estrogen or testosterone) and moreover that the effect on bone density is dependent on the time an individual has been on HRT. In addition, bone density can also be affected by whether the individual started the hormones before or after puberty. The methods for this research project are to reach out to local hospitals and gender affirming care clinics for scans CT (Computed Tomography), MRI (Magnetic Resonance Imaging), etc. of individuals before and after they started hormones to determine if there is any visual change or overall change in bone density. Then a survey will go out to the transgender community on the University of Nebraska-Lincoln's campus to ask their opinions on how far they are likely to go with surgeries/care, how

long into their transition they plan to get or got that care, if they participated in HRT how long did it take for them to see results, and what was that process like for them. This will hopefully help shape new/updated standards for sex estimation in forensic anthropology since it is an identifying aspect of individuals that could help with positively identifying more individuals. The updated standards will add the cultural side of gender while also assessing the osteological sex the individual was born as (Fuentes 2012). Sex and gender are normally used interchangeably in society so this will be a more biocultural approach to account for biology (sex) and how individuals perceive themselves in their culture (gender) (Fuentes 2012). This will also help ensure that members of the LGBTQ+ community who are victims of crime are identified and have an equal voice (through the study of their skeletal remains) in reconstructions of the circumstances of their death.

Previous Research

Previous research done by Taylor (2021) at Radford University under Dr. Donna Boyd looked at how facial feminization surgery affected the current metric (Langley et al. 2016/FORDISC 3.1) and visual standards (The Walker Method [2005]) that are used in the field of forensic anthropology to estimate sex. These visual methods can also be described as macromorphoscopic as they are traits that affect the way soft tissue is presented on the cranium (Hefter and Linde 2018). The visual methods are normally split into five categories (bone shape, bony feature morphology, suture shape, trait presence/absence, and feature prominence/protrusion), which are normally used in population affinity estimation but relate to the visual sex estimation techniques for the cranium as well (Hefner and Linde 2018). Due to sex being biological and gender being cultural, it is important to take into consideration how gender affirming care may affect

the accuracy of methods that were made without gender in mind (Fuentes 2020, Schall et al. 2020, Buchanan 2011). Individuals who have undergone Facial Feminization Surgery (FFS) for the purpose of Male-to Female (trans-women) gender transition, along with individuals who undergo Female-to-Male gender transition, are becoming increasingly common in forensic samples (Buchanan 2011). Facial feminization surgery is the alteration of masculine cranial morphological features (Schall et al. 2020, Buchanan 2011) and includes forehead reduction and contouring, chin and jaw contouring, rhinoplasty (nasal bone surgery), and cheek enhancement.

The methods of this research included looking at 16 skulls with known sex from ANSC and FSI collections at Radford University and performing the metric and visual standards before the sex was known. The statistical analysis that was done in FORDISC 3.1 (Ousley and Jantz 2006) produced the correct sex estimation only 62.5% of the time while the visual/Walker Method produced the correct sex estimation 93.75% of the time. Some reasons for this are results show that FORDISC 3.1 relies mostly on the shape of the cranium rather than the size while The Walker Method focuses on the size/robusticity of the five features. Even though this research was not done on skulls that have undergone facial feminization this shows that with the Walker Method forensic anthropologists will be able to see the modification made on the skull by FFS and mention the possibility of the individual being transgender. On the other hand, FORDISC 3.1 will be affected by the screws and plates put in during FFS and are still likely to label the individual male even though they identify as female. Other researchers like Ramsthaler et al. (2011) and Williams and Rodgers (2006) have obtained similar findings.

A solution that has also been found by other researchers is to separate sex and population affinity in FORDISC (Guyomarc'h and Bruzek 2011) because both are currently looked at together so there is a likelihood that sex and population affinity are weighted equally in the program. This could also be done by having FORDISC focus on shape and size measurements equally (Guyomarc'h and Bruzek 2011) and to decrease human error in reporting measurements with better descriptions meant to encompass multiple experience levels (Walrath et al. 2004). The inter- and intra-observer rates using the Langley et al. (2016) manual is also currently being studied by Klemm, Taylor, and Belcher (in prep.) at The University of Nebraska – Lincoln. Also, making forensic anthropologists aware of what the markings left on the bone look like and other surgeries that occur, such as removing of floating ribs and removing toes (Buchanan 2014) could be a solution to make a better estimation that the individual may have undergone gender affirming care. Some solutions that may not directly involve forensic anthropologists but can help is to construct a database for transgender people to put in their surgery status information to help identify them (Garofalo and Garvin 2020). Along with working with law enforcement officials to make sure proper questions are being asked to the individuals reporting the person missing so we know to look for identifying features of gender affirming care. Lastly, on a governmental level work on getting the laws across the United States on when documentation (Driver's License, Birth Certificate, etc.) can be changed to be the same/add gender category to the documents as the laws for changing documentation vary by state.

Even though those are viable solutions some problems may arise from those solutions. For example, a database for transgender individuals to put their information in

could become a tool for discrimination (Garofalo and Garvin 2020). The documentation standards across the United States are currently a problem as many states have different requirements on when or if an individual can change their biological sex to their gender or add a gender category on items like birth certificates and driver's licenses. Around half of the states in the United States allow for an “X” marker to be put as a gender marker on an individual's driver's license (Migdon 2022). As of 2022, there are 16 states (California, Colorado, Connecticut, Illinois, Maine, Michigan, Nevada, New Jersey, New Mexico, New York, Ohio, Oregon, Rhode Island, Utah, Vermont, and Washinton) along with Washington D.C. that allow residents to change their birth certificates to an “X” gender marker. Twenty-two states allow you to change your driver’s license to an “X” gender marker as well. Of the states that allow you to change your driver's license or birth certificate to an “X” gender marker, there are seven states and two U.S. territories (Georgia, Guam [U.S. Territory], Iowa, Kentucky, Louisiana, Northern Mariana Islands [U.S. Territory], South Carolina, Tennessee, and Texas) that require proof of surgery, court order, or altered birth certificate to change your driver's license. There are also 13 states and one U.S. territory (Alabama, Arizona, Arkansas, Georgia, Guam [U.S. Territory], Iowa, Kentucky, Louisiana, Missouri, Nebraska, New Hampshire, North Carolina, North Dakota, and Wisconsin) that require proof of surgery or court order to alter your gender on your birth certificate. Lastly, there is one state (Oklahoma) that states that the placement of an “X” gender marker on your birth certificate is banned (Migdon 2022).

With each state having a wide range of laws on whether individuals can change their gender on legal documents and what is required, it makes it difficult when missing

person reports are made and discrepancies can occur depending on who reports them missing. This can also be confusing regarding positive identifications as driver's licenses can point to a positive identification even though it may not be the full reason behind the identification. Along with the possibility of misgendering by a forensic anthropologist or law enforcement, there is the possibility that an individual in a public area can be confronted because of what is on their ID possibly leading to hate crimes (Garofalo and Garvin 2020). It is also unclear if/how the changing of these documents may be tracked, meaning if law enforcement looks up an individual in a database it will show when they may have changed their documents and what they changed it to. If there is no documentation or tracking of when items are changed it could result in more confusion and the likelihood that people may be excluded as a possible match leading to more unknowns.

Along with the legal issues that vary by state, you also must consider that individuals may jump to the conclusion that someone is transgender, but they need to be aware that there is natural variation already present (Garofalo and Garvin 2020). Lastly, changing laws and how law enforcement asks questions will take a lot of time and can face push back so it may take a long time for certain changes to be enforced depending on the state and the views regarding the topic of gender affirming care.

This research will continue to expand by looking at how HRT changes bone density and how that will affect sex estimation. It has also been found that individuals who undergo hormone treatment may have some changes to their skeleton, but it depends on whether the individual took these hormones before or after puberty (Garofalo and Garvin 2020, Unger 2016, Davidge-Pitts and Clarke 2019, Stowell et al. 2020). Also,

Female-to-Male transition has not been looked at a lot in forensic anthropology because more surgeries affect areas like the cranium in male-to-female transitions, for example, facial feminization surgery, so most researchers tend to focus on that type of transition. This is because female-to-male transitions require more hormones than surgical procedures and with this being a more recent phenomenon forensic anthropologists do not have a sample of people who have taken hormones both before or after puberty to see the exact effects on the bone and how these effects might vary by person, so this is also a component of my proposed research.

Background

While forensic anthropologists routinely and accurately estimate osteological sex from the human skeleton, based on cranial as well as postcranial features (Spradley and Jantz 2011), they have not until recently been called upon to identify gender. This has resulted from the fact that now individuals can change their sex legal documentation to match their identified gender. Additionally, the current methods that forensic anthropologists use do not consider gender. The words sex and gender tend to be used as if they are interchangeable, but they mean two different things (Fuentes 2012). Sex is biological, a person will be either labeled male or female based on their phenotypic and genotypic traits (Garofalo and Garvin 2020, McLaughlin et al. 2023). The only exception to those two categories is intersex individuals that are born with a different chromosomal structure, for example, XXY, and can have indeterminate genitalia. Intersex individuals have different sexual anatomy or morphology from people that are typically labeled male or female and occur in 1 in 1000 births. So along with transgender individuals, forensic

anthropologists need to be aware of intersex individuals in terms of identification (Garofalo and Garvin 2020).

Gender, unlike sex, is associated with social roles, constructs, and how one may view oneself, meaning that gender is not biologically determined (Garofalo and Garvin 2020). Currently, the acronym for the community that embraces everyone's different gender and sexual orientation is LGBTQQIAP2, and it stands for Lesbian, Bi-Sexual, Transgender, Queer, Questioning, Intersex, Asexual, Pansexual, and Two-Spirit, but it is often shortened to LGBTQ+ (Garofalo and Garvin 2020). Individuals who identify as transgender are normally diagnosed with gender dysphoria, which is a condition where the individual's emotional and physiological identity does not match their biological sex (Unger 2016, Davidge-Pitts and Clarke 2019, Garofalo and Garvin 2020, Stowell et al. 2020).

Normally forensic anthropologists only focus on biological sex, thus there is not a lot of published information surrounding the topic of gender in forensic anthropology. What has been published on the topic of Facial Feminization Surgery (FFS) shows there are clear modification marks left on the bone from the shaving down of bone. The researchers that have examined facial feminization surgery focused on how the surgical procedures (jaw contorting, cheek enhancement, forehead reduction, and rhinoplasty) are done to make the skull more feminine and may or may not change the result of sex estimation (Schall et al. 2020). Statistical comparisons of cranial (metric) size dimensions of trans-women tend to still label them as male compared to ordinal scale features designed to portray cranial morphology (i.e., the ordinal comparison identified the trans-women as female since they could consider surgeries) (Schall et al. 2020).

Worldwide there are approximately 5.8 per 100,000 persons who identify as trans-gender women and 2.5 per 100,000 persons who identify as trans-gender men (Stowell et al. 2020). This can equate to 1.6 million individuals over the age of thirteen and 300,000 youth individuals in the United States (Stowell et al. 2020, Flaherty et al. 2023). In both transgender and cisgender individuals' estrogen plays a significant role in bone remodeling, metabolism, and keeping the bone thickness within physiological levels which can lead to changes as they start to undergo hormone therapy (Fighera et al. 2019, Stowell et al. 2020, Davidge-Pitts and Clarke 2019). An estrogen deficiency can lead to bone resorption and an imbalance in bone formation. Testosterone helps with increasing muscle mass and promotes bone health preservation (Unger 2016, Stowell et al. 2020, Davidge-Pitts and Clarke 2019). It has been seen that trans-men and trans-women tend to have an increase in bone mineral density after being on hormone therapy for a year as well as trans-women losing lean mass due to testosterone (also known as androgen) deprivation and trans-men having larger cortical bone due to the addition of testosterone (Fighera et al. 2019, Stowell et al. 2020, Davidge-Pitts and Clarke 2019).

The way hormone therapy is managed depends on what sex the individual started at originally. Individuals that undergo hormone therapy also must meet the criteria for the therapy which can include the diagnosis of gender dysphoria by an accredited mental health professional, the ability to consent and make fully formed decisions, being the age of majority (also known as the legal age of consent), and the control of any medical or mental conditions that could act as a comorbidity (Unger 2016, Davidge-Pitts and Clarke 2019, Stowell et al. 2020). Some comorbidities that are taken into consideration are the individual’s overall mental health, tobacco use, previous bone fractures, alcohol abuse,

eating disorders, baseline low bone density, family history of osteoporosis, and many other diseases that could affect the individual's mental or physical health (Unger 2016 and Stowell et al. 2020). For individuals who are going from a biological female to a male, they undergo testosterone therapy which is a similar treatment to what they do for biological males who have been diagnosed with hypogonadism (Unger 2016). The purpose of testosterone therapy is to masculine the individual and suppress the hormones that are present in a biological female. The way the individual takes testosterone can vary on whether they live in the United States or Europe because there is an Oral formula of testosterone that was made available in Europe but is not approved in the United States due to concerns of metabolic effects. In the United States, the most common form of testosterone therapy is by injection via intramuscular or subcutaneous (Unger 2016 and Stowell 2020).

Before hormone therapy is started for both female-to-male and male-to-female transitions, most medical centers do tests to establish baselines for their lipids, red blood cell count (hematocrit), and bone mineral density (if there is an enhanced risk for osteoporosis) since these factors will likely change once testosterone is introduced to the individual (Unger 2016). The goal for most individuals undergoing a female-to-male transition is to reach 300-1,000 nanograms per deciliter (ng/dL) of testosterone. This is normally achieved by providers starting their patients at half an anticipated dose to see their body's reaction and then raising the dose slowly to make sure there are no reactions (also known as titration). It has been seen around six months of an individual being on hormones that the lower dose and higher dose produce the same results due to the body

becoming “dose-dependent” (Unger 2016). But there also have not been clear studies that show how raising doses faster may affect the individual’s body.

Hormone therapy for individuals going from male to female includes estrogen, exogenous, and anti-androgenic therapy (Davidge-Pitts and Clarke 2019, Unger 2016). The goal is to change the distribution of body fat, reduce the growth of facial hair, and induce breast formation. Exogenous therapy reduces the hormones that are released to decrease the amount of testosterone in the body and estrogen alone will not provide the desirable results. Due to multiple different therapies being needed, there are a lot more options for what can be used from patient to patient so there is still research being done to see the risks and benefits of each treatment (Unger 2016).

Even though the hormones affect each person differently some basic characteristics can be seen at certain stages of hormone therapy (Unger 2016). Hormone therapy is also tailored to everyone's goals, meaning what features/changes the individual would like to see. On average though for transgender men, it can be expected to see the absence of menstruation (amenorrhea), increased body and facial hair, an increase in acne or skin changes, increased muscle mass, changes in fat distribution, and an increased sexual drive (libido). Later in their transition, it can also be expected to see thinning of the vaginal walls (atrophy of the vaginal epithelium, also common during menopause), a deepening of the individual's voice, and an increased clitoral size. Some things may not be able to be changed depending on whether an individual started hormones before or after puberty. For this research, we are focusing on individuals who started after puberty so it is likely that the transgender men will have a shorter stature, some degree of a feminine fat distribution, and have a broader pelvis than biological males. For

transgender females, there are fewer clear lines of when they should expect to see change due to the number of hormones/therapies they must undergo. This could lead to them seeing changes like breast growth, increased body fat, slower growth of body/facial hair, erectile dysfunction, and decreased testicular size over 18 to 24 months after they started treatment.

Even though estrogen and testosterone help with the bone's overall health it has been seen that transgender women have a higher risk for bone loss (Unger 2016). One of the main beliefs behind this is that the anti-androgen treatment may negatively affect the patient if they underwent an orchiectomy (removal of one or both testicles) due to there not being as much testosterone in their system. Other studies are looking at if transgender individuals are more vulnerable to other diseases or complications but there have not been clear findings in many of them (Unger 2016). It is also important to note that the hormone therapy treatments that transgender men undergo are based on other treatment methods for postmenopausal women and biological men with a hormone deficiency (hypogonadal) and most of the steps behind monitoring and prescribing hormones are not recommended for individuals under the age of seventeen (Unger 2016). There are other multidisciplinary treatments recommended for individuals under seventeen diagnosed with gender dysphoria (Unger 2016).

Overall hormone therapy does not only affect the bones and soft tissue on the individual's body, but it helps improve the individual's quality of life (Stowell et al. 2020, Unger 2016). This has been seen in individuals who have been on hormone therapy for twelve months or more and have a lower level of perceived stress (Unger 2016). Those lower levels of perceived stress are why some health professionals decide to start

individuals under seventeen years old on hormones as delaying care in some scenarios can result in psychological and cognitive trauma. Even in those cases it is common for those individuals to be given pubertal suppressants until they turn seventeen and then they will start hormone therapy, but each case should be handled by a professional and vary by individual the same way it does with individuals over the legal age of consent that undergo hormone therapy (Unger 2016).

Not only do the hormones affect the way the individual's bone may present their sex and/or gender but the standards the field of forensic anthropology use may affect the accuracy of those estimations as well. In forensic anthropology there are standards writing guidelines that must be followed and the type of standard varies by its overall goal (Figure 1.1) (McKiel 2019). Along with standards, there are also technical reports that may have data from surveys or other sources of information but do not provide rules or guidelines for the field (Figure 1.2) (McKiel 2019).

Standards are common and repeated use of rules, conditions, guidelines or characteristics for activities or their results, aimed at achieving the optimum degree of order in a given context. Standards exist as:

- Specification standards – contain requirements which can be implemented and, if desired, audited for conformance or non-conformance.
- Guideline Standards – written to assist in the interpretation and implementation of specification standards. These standards do not contain auditable requirements.
- Best Practices Standards- written either as specification standards or guideline standards.
- Publicly available specifications (can also be referred to as Technical Specifications or other names) – written to address an immediate safety or health concern but exist for a limited time only (3-5 years), after which they are either put through the normal standardization process or are withdrawn.

Standards of any kind that are issued as American National Standards, must be developed in conformance with ANSI's Essential Requirements: Due Process Requirements for American National Standards. This process means that SDOs submit the proposed standards for public review and comment.

Figure 1.1: Academy Standards Board (ASB) (McKiel 2019) definition of the distinct types of standards.

A Technical Report (TR), by contrast, does not contain rules, guidelines, conditions or requirements. TRs are informational only and may contain, for example, technical research, tutorials, factual data obtained from a survey or other mechanism, or information on the 'state-of-the-art' developments in relation to standards on a particular subject. Further, TRs:

- Do not necessarily reflect a consensus opinion,
- Can be published without a public comment period,
- May contain multiple viewpoints,
- Can be published in as little as 6 to 8 weeks once the writing is completed
- Can be registered, if so desired, with ANSI to encourage widespread use and acceptance.

Technical Reports offer a major benefit to the standards community. When a sector, field of work, or technology is not ready for standardization, a TR is a bona fide way to share and get feedback on information that may lead to the development of a standard. For example, a TR may be based on an initial working draft for a standard to be developed, or it may present material that was considered for – but finally not included in – a standard. TRs are reviewed every three years to assess ongoing relevancy.**

Figure 1.2: ASB definition of a technical report and how it compares to standards (McKiel 2019).

The reason those terms are important to this research is related to ANSI/ASB Standard 090 First Edition 2019: *Standards for Sex Estimation in Forensic Anthropology* and how standards could be updated to include how forensic anthropologists address gender affirming care. In this standard the ANSI/ASB mentions that “Gender cannot be determined from skeletal remains” while also saying “Conflicting morphological and/or metric indicators of biological sex should be documented and described. Contextual indicators inconsistent with the estimated sex may also be noted” (ANSI/ASB Standard 090, 1st Ed. 2019, Pg.3). It is important to note that the conflicting morphology may be due to gender affirming care, but there are currently no standards or teachings to help

forensic anthropologists know what to look for (marking left from surgeries, bone density changes, etc.). The overall goal of this research is to bring awareness to a minority population that may be falsely identified and update standards to account for the possibility that forensic anthropologists are dealing with the remains of a transgender individual that has updated their documentation to no longer include their biological sex. The field currently labels individuals as “female, male, probable female, probable male, or undetermined” (ANSI/ASB Standard 090, 1st Ed. 2019, Pg.3), so adding a possibly transgender category could lead to more individuals remains being returned to loved ones rather than sitting in a lab or department labeled as unknown to only be checked at least every couple years.

Chapter 2: The Effect on the Field of Forensic Anthropology

There is a gap in research regarding this topic because it represents a recent topic of discussion in biological and forensic anthropology (Flaherty et al. 2023). There has been research on male-to-female transitions since more surgical marking is left on the bones (Schall et al. 2020). The surgeries that are currently offered for all transgender individuals are mastectomy's (surgically removing the breasts), hysterectomy and ovariectomy (surgically removing the ovaries and uterus), orchiectomy, facial feminization surgery, and metoidioplasty or phalloplasty (the creation of a penis). It has been found that gender confirming surgeries are more common in transgender men (42-54%) than in transgender women (28%) (Nolan et al. 2019). Chest surgeries (both the removal and addition) are one of the most common surgeries in both transgender males and females (8-25%) compared to genital surgery for both transgender males and females (4-13%) (Nolan et al. 2019). The reason chest surgeries are more common is that genital surgeries are likely due to chest surgeries playing more of a role in the outward gender expression and chest surgeries are easier for plastic surgeons to perform (Nolan et al. 2019). Another surgery that plays a role in outward expression of gender for transgender women is facial feminization surgery which has been reported to occur in 3-8% of individual who identify as a transgender woman. Other surgeries are hysterectomies in transgender men (14%), phalloplasty in transgender men (3%), and other outward gender expression procedures (hair removal, contouring, etc.) take up 10.6% of all transgender inpatient hospital visits (Nolan et al. 2019).

Most of these only affect soft tissue but there is a possibility of it touching bone if there are any complications or miscalculations in the procedure. These surgeries and hormone therapy have become more likely to be prescribed to individuals by a doctor now than in past years due to clinicians taking measures beforehand to make sure the patient is in the right mental space as well as appearing to the patients as open and less likely to "gatekeep" (Unger 2016). This helps the patient not have to find hormones from an unlicensed resource and helps professions like forensic anthropologists have access to a documented history of the hormones or surgeries they have undergone which can help with their identification process.

The reason that process is important to forensic anthropologists is that transgender individuals are part of a group that has structural vulnerabilities that can be combined with things like homophobia or racism that make them more likely to be a victim of a hate crime that can result in death (Flaherty et al. 2023 and Byrnes, Sandoval-Cervantes 2022). Hate crimes were not well documented before 2009 when *Matthew Shepard and James Byrd, Jr. Hate Crimes Prevention Act of 2009, 18 U.S.C. §249* was passed and required the FBI (Federal Bureau of Investigation) to keep track of every hate crime case that happened to juveniles, but adult hate crime cases were not required until 2013 (Flaherty et al. 2023). From 2013 to 2019 over 1,000 individuals responded to the National Crime Victimization Survey (NCVS) stating they have been a victim of a hate crime due to their gender identity, but this is underrepresented due to distrust, inadequate access to the resources to take the survey, or fear of retaliation from their abuser. From 2020 to 2022 hate crimes have increased by approximately 12% and can encompass anything from an assault, both simple and aggravated, to homicide (Adams et al. 2024).

Within those hate crimes gender identity, sexual orientation, or race accounted for more the 75% of the cases reported as hate crimes (Adams et al. 2024). It has also been reported that in the year 2023, there were approximately 140 deaths globally of transgender individuals. Along with those deaths it has been estimated that there are approximately 100 cold cases of transgender individuals currently in the United States (Flaherty et al. 2023).

Those statistics do not include the suicides that take place in the transgender population as well. Things that play into transgender individuals attempting to commit suicide are physical and sexual assault, harassment, bullying, rejection from their family/loved ones, and discrimination (Flaherty et al. 2023, Fuentes et al. 2023). It has been found that approximately 64% of individuals who identify as transgender will attempt suicide while the national average for the general population is 0.5%. This means that the attempt rate for transgender youth and adults is nine times higher than the attempt rate for the general population (Flaherty et al. 2023). But what is not considered most of the time when reporting these statistics is how off they might be due to the reports misgendering the individual by police, forensic analysts, media, or family members releasing information. It has been reported from 2012 to 2013 alone that in 74% of all the reports in the United States relating to transgender homicides, the individual was originally misgendered. On top of that databases like the National Missing and Unidentified Persons System (NamUs) do not offer an area for family members to include gender expression or gender identity in their case. There are also no federally funded or national databases that track transgender death statistics in the United States (Flaherty et al. 2023, Garofalo and Garvin 2020). Another aspect to consider is that there

is also the possibility that the person reporting the individual missing is not a member of their biological family but their "chosen family," meaning a group of people that the individual is close to due to estrangement from their biological family (Adams et al. 2024). Even though their "chosen family" may try to report the individual missing, it is a common issue that these individuals are ignored as they are not related to the missing individual. This may lead to the case being filed later or not being filed at all, which may impede or delay the identification process further (Adams et al. 2024).

Overall female-to-male transitions are less represented in the literature, as most of their transition is done due to hormone replacement therapy. Thus, while changes in bone morphology may occur, there are no known marks for forensic anthropologists to examine. As this is a more recent phenomenon, forensic anthropologists do not have an adequate sample of people who have taken hormones both before or after puberty to examine any effects on the bone and how these effects might vary by individual. But if we know some of the procedures and how transgender individuals undergo transitioning, then forensic anthropologists can try to better understand any changes using a multi-disciplinary approach of how to estimate gender from remains. This is because even though our standards only account for sex estimation there are visual markers at times that may be ignored then leading to forensic anthropologists unintentionally oppressing these individuals by ignoring their gender and only reporting their sex (Adams et al. 2024). With this deadnaming, the act of calling a transgender individual by the name they went by before their transition, is more likely to happen and cause unintentional violence or oppression which could be avoided by expanding the field to look for certain markers of surgeries or hormones that would help someone be labeled as a possible transgender

individual widening the possibilities for a positive identification (Flaherty et al. 2023). There are a lot of unknowns in this realm of forensic anthropology, but it is important to attempt a beginning to understand how this could affect sex estimation, to ensure people are identified in the future.

This research is also important to the field of forensic anthropology because not only is this an issue that has not been addressed in our current standards (Langley et al. 2016) but even in the medical field the topic of bone mineral density (BMD) in transgender individuals has been controversial (Davidge-Pitts and Clark 2019). When assessing fracture risk in individuals they are compared to others that have the same biological sex but when the individual is transgender the medical field debates if they should be compared to their gender or their biological sex. Typically, the bones are affected by sex steroids like estrogen and testosterone during puberty which makes biological males have a greater bone density and biological females have a smaller bone density. But if an individual is undergoing hormone therapy for a long time there is likely to be a change in the bone's overall density. My research focuses more on individuals who have started hormone therapy after puberty, but this situation can get even more complicated if you take into consideration the individuals who started hormone therapy before puberty (Davidge-Pitts and Clark 2019). This research will also help bring awareness and viable solutions to how forensic anthropologists should handle sex estimation on transgender remains.

Forensic anthropologists who deal with casework frequently have been asked if they know what these remains may look like and how to perform the biological profile on them and answered that they were unsure and that only 28.9% have ever dealt with

transgender remains (Flaherty et al. 2023). With the statistics of the number of suicides and homicides that affect the transgender community, a larger percentage of anthropologists have likely dealt with transgender remains unknowingly, which could be why there are over 100 cold cases involving transgender individuals. One of our mainstays in forensic anthropology is the use of the discriminant function analysis database FORDISC 3.1 (Ousley and Jantz 2006), which allows an analyst to population affinity and sex together and may lead to misidentifications of marginalized populations; especially given the fact that we have a much smaller sample for comparison. The number of transgender individuals in the United States is increasing and the field of forensic anthropology needs to start taking into consideration how gender is handled both with macromorphoscopic (visual) and metric methods and how we can better identify transgender individuals to hopefully reduce the number of cold cases and return more individuals home to their loved ones.

Overall, forensic anthropologists function as supporters and advocates for marginalized populations, such as the LGBTQ+ community, since we play a role in the identification process, which can tell a story of that person's life (Adams et al. 2024). Traditional activism and advocacy have not played a huge role in scientific fields because they have been defined as “active,” meaning someone is constantly pushing/fighting for change. Due to the lack of diversity in forensic anthropology when it was first established in 1972 (Passalacqua and Clever 2024), there has been some pushback to ideas or research that involves advocating for marginalized populations. It has been found that in the *Journal of Forensic Science* from 2000 to 2018 only 0.8% of all publications revolved around ethics/theory which could be due to the Daubert standards making

individuals want to remain neutral and objective so when they testify as an expert witness, they are less likely to be undermined or questioned on their advocacy or activism in the field (Adams et al. 2024).

Even though neutrality in a case may be important, forensic anthropologists can be advocates as serving as an expert witness can amplify underrepresented voices more (Adams et al. 2024, Byrnes and Sandoval-Cervantes 2022). There are many ways forensic anthropologists can be advocates and participate in activism but some of the most effective ways would be to have more conversations in the communities they work in, work on more inclusive methods, acknowledge past mistakes in the field, continually look at things through a critical lens, and many other things (Adams et al. 2024). Marginalized communities are overrepresented in the forensic population of suicides or homicides, so this research focuses on the transgender population that is currently not being considered in our current sex estimation methods (Adams et al. 2024, Byrnes and Sandoval-Cervantes 2022). This will involve advocacy from a research perspective along with including the communities' opinions on their experience during transitioning, when they consider someone transgender (e.g., Are hormones or surgeries required in the community to label themselves transgender), and their opinions on how laws on changing legal documents to show gender could be implemented with this research. This ensures their concerns are considered too, and we are not just focusing on the impacts to the field but the wider implications.

Chapter 3: Methods and Processes

This research will focus on how HRT may affect forensic anthropology's current sex estimation techniques. I hypothesize: (1) that there will be differences in how HRT affects the bone depending on the age of the individual when they start HRT; and (2) like my past research (Taylor 2021, manuscript in progress), the visual methods will continue to perform better when compared to metric methods. However, there may be a way to determine microscopically if the individual has undergone HRT, which could support what is seen in the visual sex estimation. Steroids that are given in HRT are important for regulating skeletal growth, peak bone mass, and bone mass maintenance in both male-to-female and female-to-male surgeries, so it has been hypothesized the hormones would change the overall bone mass density (Buchanan 2014).

This research has multiple methods for collecting data including surveys and looking at medical scans of individuals undergoing HRT. Due to the sensitivity of the data and surveys being sent to individuals who identify as transgender, this research has been submitted to the Institutional Review Board (IRB) at the University of Nebraska – Lincoln (UNL) for approval (submitted in Spring 2023) and approved in March 2024. Throughout the IRB process, access was allowed to reach out to hospitals and clinics that specialize in HRT and determine if the medical researchers would be willing to send anonymized scans from an individual's treatment to determine if the hormones are affecting their body properly. This is defined as keeping a reasonable bone density throughout treatment, which can be seen from scans taken due to injury, such as a broken bone. After reaching out to 15-20 institutions, Drs. Justin Stowell and Caroline Davidge-Pitts (also known as Health Care Providers [HCP] from the Mayo Clinic in Rochester,

MN have agreed to provide approximately 120 scans (a mix of CT (Computed Tomography), MRI (Magnetic Resonance Imaging), and X-ray) of individuals that are above the age of 19 years old (the legal age of consent in the state of Nebraska).

Once the UNL IRB approved the application (March 2024), the next step is currently filling out the IRB through the Mayo Clinic to ensure that both parties are following the specific institutional regulations regarding what information is being shared and how it should be processed. The timeline for approval through the Mayo Clinic is unknown but should take a shorter amount of time due to the medical researchers knowing the process in more depth for their institution as well as the current data are already being anonymized due to past research. Once approval is given from both parties' institutions, a secured flash drive will be sent to the medical researchers at the Mayo Clinic, via FedEx, where they will upload the scans along with other pertinent files. The other information being asked for is the individual that is transitioning biological sex or what they are transitioning to (depending on how they have it in their records), the individual's age range, how long the individual has been on HRT(in a year range), what hormones the individual is on and dosage (if possible) if the individual had any surgeries to the area in the scan, and if the individual did have surgeries, were they related to gender affirming care (Figure 3.3). The individuals' age and how long they have been on HRT will both be given on a scale that counts by tens to help keep everything anonymous or be able to be connected to an individual.

Items Being Requested from HCP's:

- Scans of individuals that are undergoing HRT (X-rays, CT, MRI)
    - These will be used to see if any sex identifiers forensic anthropologists use has changed due to the hormones
- The age ranges the individual falls in (19-30, 31-40, 41-50, 51-60, 61-70, 71 and older)
    - This will help show if age affects how the hormones affect the bones
- What hormones that the individual was given (testosterone, estrogen, etc.)
    - This will help determine if they were biologically female or male before hand
- The dosage (full dose, half dose, quarter dose)
    - This will help show if the amount of HRT they are under has different effects
- How long they have been on HRT in ranges (under a year, 1-2 years, 3-4 years, 5-6 years, 7-8 years, 9-10years, over 10 years)
    - This will help draw conclusions on how long it may take to see changes in the bone density
- All information will be made anonymous by the HCP and all information will be given in ranges to ensure that the individual that the scans are from cannot be identified.

Figure 3.3: The items HCP's will provide along with how they will be provided in ranges.

Once the information has been transferred to the secure/encrypted flash drive, the medical researchers will send it back to UNL so the analysis can start. The analysis will include looking at the individual's bone density and seeing if there is any change before HRT scans are provided. This could be seen by the darkness of the bone getting whiter on the scans due to the loss of density or vice versa. If there is a change, then it will be noted how long the individual has been on HRT, their age, and their biological sex to see if a pattern can be formed when comparing other scans. If there are no changes those items will also be noted to see if any individuals have similar timelines and treatment plans but varying results.

The other component of the research is to examine how visual sex estimation techniques work on a transgender individual: will estimate their gender or still result in

their biological sex. The methods that will be used are Walker (2008), MorphoPASSE (2018), and Klales et al. (2012). The Klales et al. (2012) method is based on Phenice (1969) and looks at the Ventral Arc, Subpubic Concavity, and the Medial Aspect of the Ischio-pubic Ramus which are all located on the pelvis and are ranked on a scale of one to five (Figure 3.4). One is feminine and five is masculine on the scale. Walker (2008) focuses on features located on the skull and ranks them on a scale from one to five that mirrors Phenice (1969) and Klales et al. (2012). The traits are the Nuchal Crest, Mastoid Process, Supra-Orbital Margin, Supra-Orbital Ridge (also known as the Glabella), and the Mental Eminence (Figure 3.5).

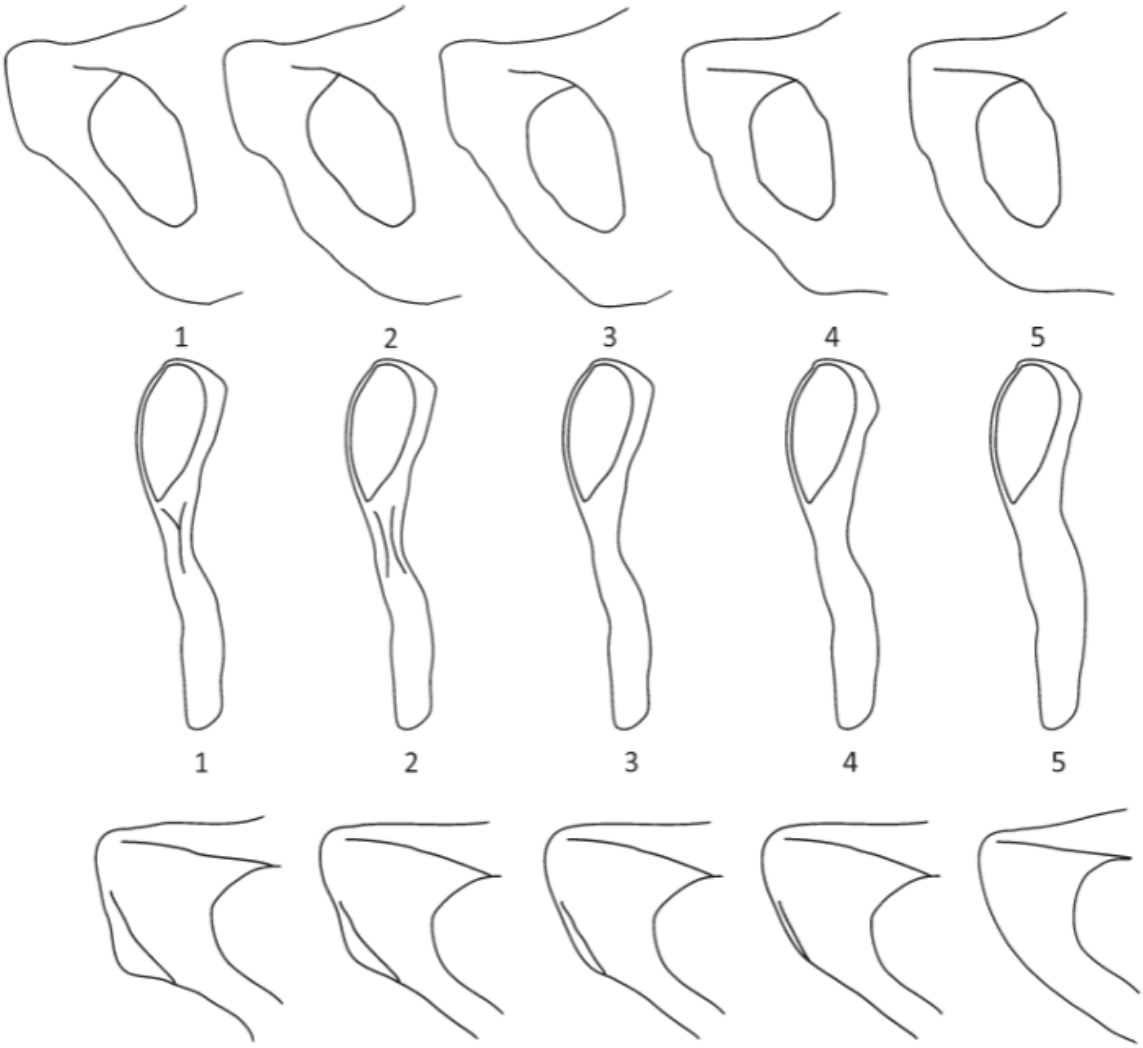

Figure 3.4: Klales et al. (2012) Visual rankings of the Pelvis

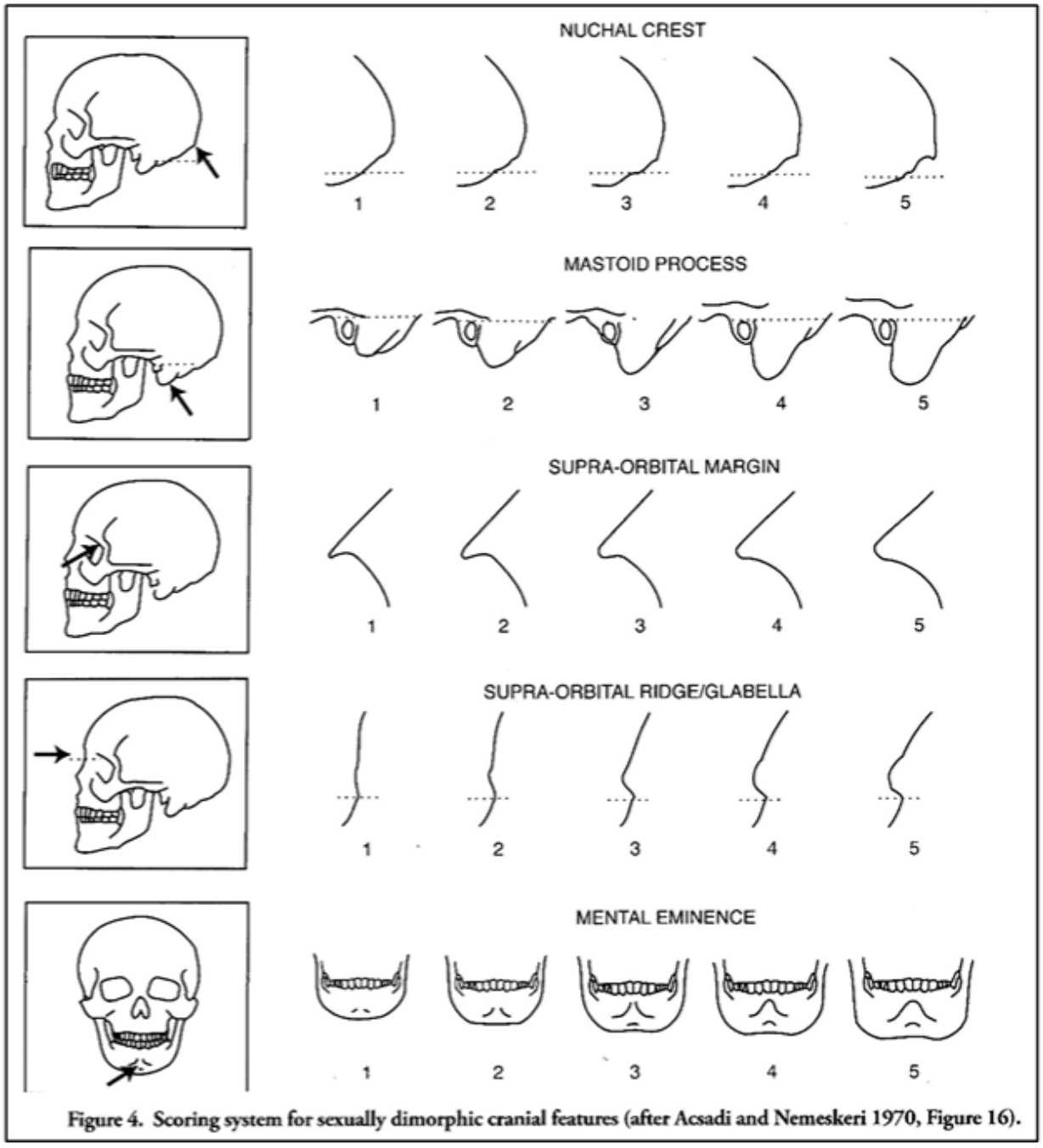

Figure 3.5: MorphoPASSE (2018) Visual rankings of the skull

MorphoPASSE (2018) takes both Klales et al. (2012) and Walker (2008) and has the forensic anthropologist put the rankings from both into the system. It then compares those rankings, with binary logistic regression and random forest modeling, to a database

of cases and known individuals from decomposition facilities and collections to see how that ranking compares to others and if it should be labeled male or female. The sources of data are William M Bass Collections, Texas State University Donated and Identification Collection, Mercyhurst Forensic Lab, The Pretoria Bone Collection (L'Abbe et al. 2005), Hartnett-Fulginiti Pubic Bone Collection (Hartnett 2010), University of Mexico Osteological Collection (Gomez-Valdes et al. 2017), Santa Maria Xigui Cemetary (Gomez-Valdes et al. 2012), Khon Kaen University (Techataweewan et al. 2017), Antioquia Modern Skeletal Reference (Toon et al. 2014), University of the Philippines Skeletal Reference Collection (Go et al.), Hamann-Todd, Robert J Terry, University of Colorado Nubian Collection (Van Gervan et al. 1995, Sandberg 2012), and The Arikara Collection (Ousley and Jantz 1978, MorphoPASSE 2018). Four of these are historic/proto-/pre-historic collections but most of them are modern collections that allow for Asian, Black, Hispanic, Native American, White, and Nubian populations to have representation from at least one collection. The hope is that MorphoPASSE (2018) may be able to notice some of the traits that have been changed due to gender affirming care due to it involving both the skull and pelvis that show sexual dimorphism.

The last component of this research will be happening simultaneously and include a survey that will be sent out to The University of Nebraska-Lincoln students who identify as transgender. The survey will be sent out through the UNL Gender and Sexuality Center which maintains an email list of groups on campus that have and support LGBTQ+ students (Figure 3.6). Along with this recruitment email, fliers will be placed in the Gender and Sexuality Center and other bulletin boards. The flyer contains a QR code that links directly to the survey along with the requirements and the IRB

number in case individuals have concerns or questions (Figure 3.7). This ensures the surveys will remain anonymous and the researchers do not have direct contact with the survey participants. This allows the individuals to feel safe responding and that there will be no identifying information available to researchers or released to protect the individuals from retaliation or discrimination from individuals on or off campus.

Recruitment Email

Dear [Name]:

I am conducting a research study on How Gender Affirming Care Affects the Current Sex Estimation Methods in Forensic Anthropology. Participation will take 15-30 minutes. If you are interested in participating, please see the attached consent form for full details along with the attached survey. There are no known risks involved in this research and all responses are anonymous.

https://forms.office.com/r/Ga3gBqYM9Y

Thank you for your time and participation!

Reminder message: Completion of a certain study step

This is a reminder that last week we sent you a survey link via email. The survey will be available for you to complete until [date survey is no longer available]. If you have already completed the survey, we thank you for your time. If you have not completed the survey, we would greatly appreciate any input you could provide.

https://forms.office.com/r/Ga3gBqYM9Y

Thank you for your time and participation!

Figure 3.6: Recruitment email that will be sent out by the Gender and Sexuality Center on UNL's campus

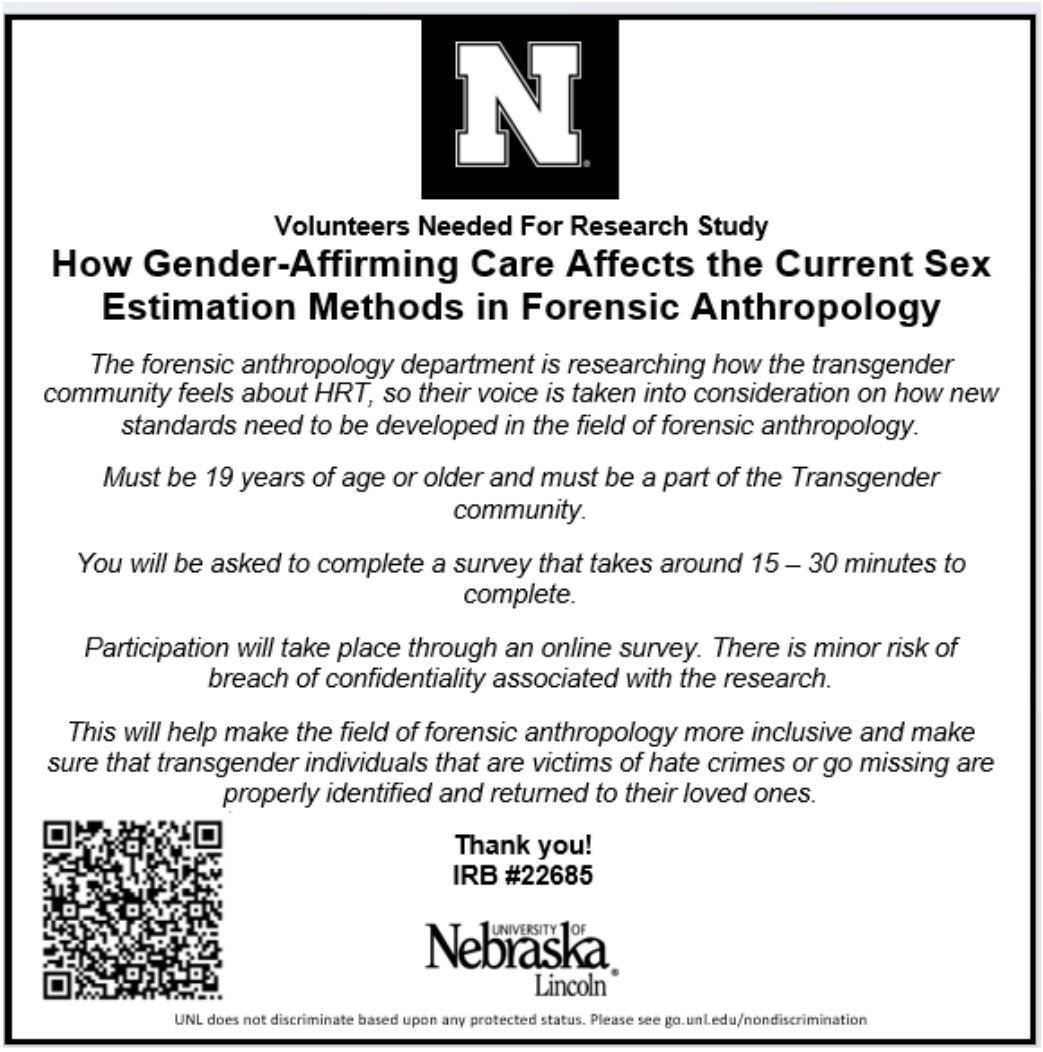

Figure 3.7: Research Survey Flyer that will be placed around UNL's campus and at the Gender and Sexuality Center.

The survey questions will be short answer style to ensure the individual can answer as much or as little as they would like about their transition process (if they have started) or their overall experience as an individual who identifies as transgender. The questions being asked of the individuals can be seen in Figure 3.8. The only questions that are required are numbers one through four since they must be 19 years old or older and identify as a transgender individual to participate. The individuals will also be asked

to read and agree to a consent form to make sure they understand how the data they enter will be used and what the survey is about, which can be seen in Appendix A.

Survey Questions

1. Are you 19 years old or older? (Yes or No)
2. Which sex were you assigned at birth (labeled on your original birth certificate)?
    a. Male
    b. Female
3. How do you describe yourself?
    a. Male
    b. Female
    c. Transgender
    d. I do not identify as male, female, or transgender
4. What is your current gender identity?
    a. Male
    b. Female
    c. Trans Male/Trans Man
    d. Trans Female/Trans Woman
    e. Genderqueer/Gender Non-Conforming
    f. Different Identity (Please State): ____
5. Have you undergone any gender-affirming treatment? (Yes or No)
    a. If so, what gender affirming treatment have you gone through?
    b. How long have you been on hormones or how long since your surgery?
6. If you are on hormones how long did it take to see physical changes?
7. If you haven't started gender affirming care, do you plan to? Why or why not?
8. Do you think for someone to identify as transgender they need to have started the process of transitioning in some way? Explain.
9. Do you think that the government should require documentation of transitioning to allow you to change your documentation to match your gender? Explain.
10. Would you be open to gender being added to documents (i.e. Driver's License) to be seen beside biological sex? Explain.
11. Are there any things you feel are important to think about/consider when discussing gender-affirming care?

Figure 3.8: Survey questions transgender students at UNL will be asked to fill out.

The IRB and the consent form are an important part of this research to ensure the participants are safe and have a minimized level of risk associated with this research (Resnick 2021). IRBs normally have approximately five individuals with a variety of backgrounds and one member who may be from outside the institution or not in the field of science (Resnick 2021). They are tasked with working with the principal investigator

(PI) to walk through the benefits this research may have for society in comparison to the risks that the individuals being asked to participate have to face. This includes forming consent forms, ensuring privacy, determining if the subjects should be paid for participating, if children or individuals are more vulnerable that protections are put in place, and that the research follows local, state, and federal regulations (Resnick 2021).

An IRB helps instill trust between the community and the researcher or researchers. In research, trust between the participants and the researchers can be a complicated idea to build and explain, but it happens over time (Resnick 2021). This is done by the researcher listing out how the participant will not be harmed, how privacy will be addressed, confidentiality, and that if the participant chooses, they can withdraw at any time. The consent form is the first place that this trust starts to form as it starts the conversation with the researcher and participant about what is required and if there are any concerns. The important aspect of the consent form is that it can be understood by a variety of education levels, meaning there is a limited amount of jargon, and is a digestible length (Resnick 2021). Trust is also built between the IRB office, the researcher, and the participant due to the expectations that everything is being overseen properly and has the best of everyone at its core.

The reason trust is the main component of the IRB, and the approved research is due to the mistreatment of marginalized populations that occurred before these systems were in place (Resnick 2021). Before World War II, there were no international ethics codes, and the first use of a consent form was not documented in medical research until the 1900s. There are many examples of the mistreatment of individuals in medical research. Some of the well-known examples are the experiments done during WWII on

prisoners in Germany against their will (known as the Nuremberg Trails), the Tuskegee Study where black men were given syphilis, the testing of how radiation affects pregnant women to find out how to survive a nuclear attack in 1940-1970, and many other cases that are coming to light (Resnick 2021 and Edwards et al. 2021).

These cases have become known by people who are called “whistleblowers” who then can put themselves in danger of assault and ruining their reputation due to them trying to protect the individuals who are being mistreated in these studies (Edwards et al. 2021). Buxton was the individual who reported the mistreatment and bribery of the Tuskegee study and can be seen as an important figure today but back then was not viewed that way (Edwards et al. 2021). Other studies like the Nuremberg trial went to court for war crimes and human experimentation but due to it being one of the first international ethical wrongdoings there were no charges placed for the Japanese scientists, but German scientists were prosecuted (Resnick 2021). The Nuremberg Code was formed and became the template of modern medical ethics guidelines (Resnick 2021). Overall, the IRB was created to help prevent these issues from happening again and plays into why it is needed for this research since the LGBTQ+ committee is a marginalized population, medical records, even though they are anonymized, are being used, and a survey of the marginalized population is being collected. This ensures the safety and consent of the patients in this research along with building trust with the community, patients, doctors, and individuals that will refer to this research in the future.

Chapter 4: Expected Outcomes

When it comes to looking at bone density that may be affected by HRT for an individual who started the therapy post-pubescent, the person may be less likely to have morphological and bone mass density changes as their skeleton is close to or already fully developed. Thus, hormones may not have an impact on osteological sex estimation. On the opposite side, it is expected that individuals who started HRT before going through puberty may be more likely to have bone density and other traits that line up more with their gender rather than their biological sex (Garofalo and Garvin 2020). When using bone mass density for sex estimation it cannot be the single and only method used since there are no ranges that will guarantee that someone is male or female from their bone density (Kranioti et al. 2019), but this will still be a good indicator to show if the hormones are changing the bone density. In general, males tend to have a higher bone density than females, and the best bones to use for sex estimation using bone mass density are complete long bones (Iscan 2005, Davidge-Pitts and Clarke 2019, Schall et al. 2020, Stowell et al. 2020).

Other expectations are that not only the age they started hormones, but their overall age will affect how bone morphology is used for sex estimation methods. Bone density is affected by age, especially in females when they go through menopause due to a hormonal deficiency (Curate et al. 2017, Davidge-Pitts and Clarke 2019, Stowell et al. 2020, Unger 2019). For female-to-male transition, the bone density should be increased in comparison to females who have not undergone any hormone therapy. That could lead to these individuals being classified as male instead of female and the opposite should be true for male-to-female transition.

With the use of MorphoPASSE (2018), there will be statistical results that can show what features were weighted more (also known as variable importance) in the sex estimation and if the sex estimation was the individual's gender (Figure 4.9). The abbreviations in Figure 4.9 show how a combination of skull and pelvis traits is considered. It can also be seen that VA (Ventral Arc) weighs more in comparison to NC (Nuchal Crest) in the equation, which is common as pelvic traits tend to be seen as more reliable for sex estimation (MorphoPASSE 2018). MorphoPASSE (2018) also provides a confusion rate where it will state the likelihood that the remains are being misclassified as male and female so it is expected to see a higher rate in transgender individuals since their remains may fall more in the neutral measurements (Figure 4.10). There is also case prediction (Figure 4.11) that gives the overall probability of the sex of the individual and model training (Figure 4.12) that cross-validates and provides the Kappa statistic to consider random chance. Then the result is the model accuracy (Figure 4.13) which will break down all the statistics in more detail which can be used in trials to give confidence intervals. Overall, it is expected to see results that are not as clear if the individual is male or female, or that the individuals that have been on hormones for a long period (possibly 5 or more years) may start to appear as their gender, meaning they will be labeled the opposite sex than what they were labeled at birth.

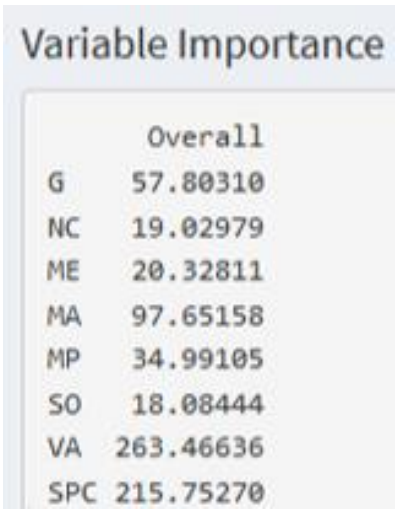

Figure 4.9: Variable Importance example output in MorphoPASSE (2018)

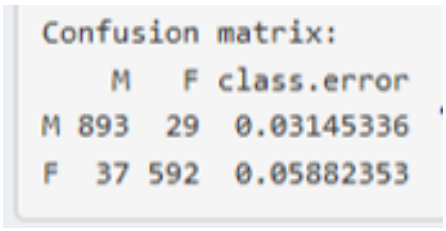

Figure 4.10: Confusion Matrix example output from MorphoPASSE (2018)

Figure 4.11: Case Prediction example output from MorphoPASSE (2018)

Figure 4.12: Model Training example output from MorphoPASSE (2018)

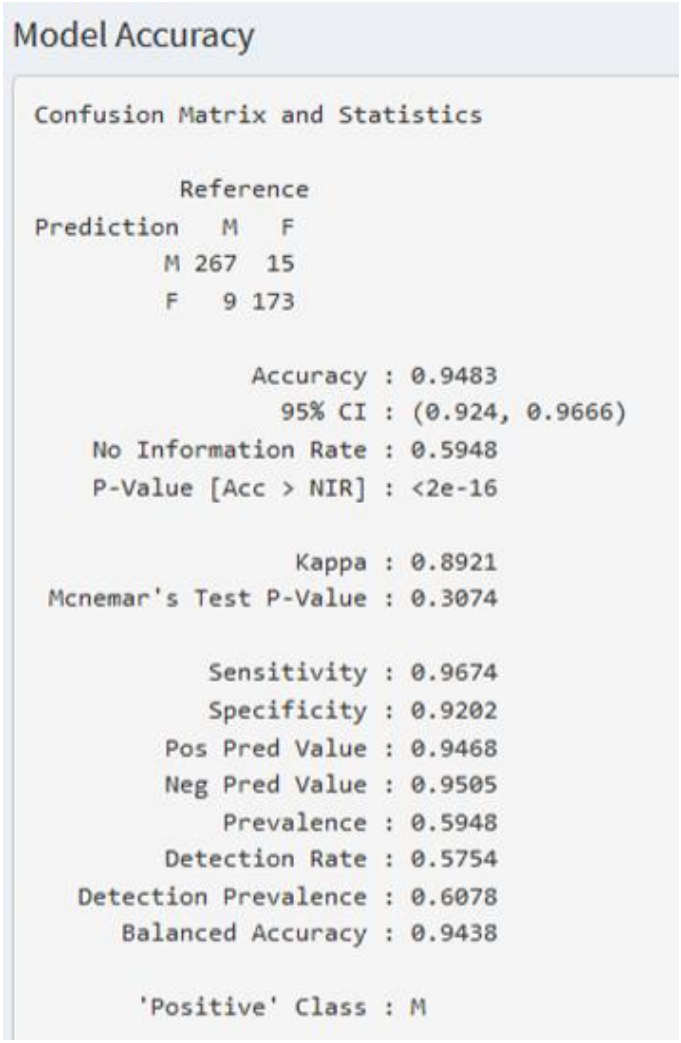

Figure 4.13: Model Accuracy output example from MorphoPASSE (2018)

Chapter 5: Conclusions/Future Research

This research shows how little has been studied about how transgender people transition and how it may affect their bodies, which then affects the accuracy of forensic anthropology's current osteological sex estimation methods. Osteological sex estimation is one of the key factors of the biological profile that leads to an individual being correctly identified so any identifying details are important. Anthropology is not the only field this research will affect, as this research can help influence laws that will affect law enforcement, the court system, and medical professionals to name a few.

Since forensic anthropologists work with law enforcement, procedural and analytical changes the discipline makes will affect them. Law enforcement will have to change the questions they ask the families of missing individuals. For example, they will have to ask if they know if the missing individual has ever gotten transgender surgeries or been on hormones so medical examiners and forensic anthropologists can be aware if they come across someone. This can also affect laws on what is required to change your sex on your documentation or lead to a gender category being added on things like driver's licenses to be more inclusive but also make sure the proper information is present in case the individual ever goes missing either because they want to or because of a violent act committed against them.

We also need to be aware that sex may currently be seen as a binary (male and female being the only options) but keeping those categories fails to show the diverse nature of the biology of sex (Fuentes 2023, Schall et al. 2020). Intersex individuals exist in society and can also benefit from this research due to them also being a marginalized

population that can be victims of hate crimes and having a mixture of hormones that can make their bones display in the midline rather than a definite osteological sex (Schall et al. 2020, Buchanan 2014, Fuentes et al. 2023). Currently, in forensic anthropology sex is seen as a binary term, where we can only report someone as being male, probable male, female, probable female, or undetermined (ANSI/ASB Standard 090, 1st Ed. 2019, Pg.3) and gender is viewed as something we should not be measuring. Updating these standards and taking into consideration that sex is not binary will help ensure that members of the LGBTQ+ community who are victims of crime are identified and have an equal voice (through the study of their skeletal remains) in reconstructions of the circumstances of their death.

Future Research

Future research regarding this study will involve the actual analysis of the scans received by the healthcare providers at the Mayo Clinic after IRB approval from both institutions. This research will be continued in my PhD studies in the School of Global Integrative Studies at The University of Nebraska – Lincoln.

Other research that can come from the findings are: 1. Can we determine if someone has undergone HRT; and, (2) Can gender be estimated from macromorphoscopic standards in forensic anthropology. Results of this future research could be expanding the dataset to include individuals that started the hormones before puberty or went on pubertal suppressants, trying to create a range or equation that can predict gender and sex from the density of the bones you are looking at (will likely be of the femur or other long bones), and revaluate other standards to help not only transgender population but other minority populations that may be marginalized are being falsely

identified with our current standards for osteological age, osteological sex, stature, or population affinity.

Forensic anthropology helps individuals who may have passed away due to unforeseen circumstances have a voice in the individual identification and, if necessary, prosecution and justice related to criminal intent. As a discipline, we need to ensure that we are inclusive and do not continue to ignore marginalized populations and we are as inclusive to as many populations as possible. This requires us to constantly look at the way we are estimating the biological profile or the research that is currently being conducted in the field to ensure it is representative of the entire population.

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Appendix A – Consent Form

IRB Project ID#: 22685

1. **Formal Study Title: How Gender-Affirming Care Affects the Current Sex Estimation Methods in Forensic Anthropology**

2. **Authorized Study Personnel**

Principal Investigator: Dakota Taylor, BS. Email: Dakota.taylor@unl.edu Office: 402.472.8376

Secondary Investigator: Dr. William Belcher, Ph.D. Email: wbelcher2@unl.edu Office: 402.472.2411

3. **Invitation**

You are invited to take part in this research study. The information in this form is meant to help you decide whether or not to participate. If you have any questions, please ask.

4. **Why are you being asked to be in this research study?**

You identify as transgender, and you must 19 years of age or older to participate in the research.

5. **What is the reason for doing this research study?**

The goal of this study is to see how gender-affirming care (specifically Hormone Replacement Therapy (HRT)) affects bone density and how forensic anthropologists may need to change their current standards so transgender individuals can be properly identified when they are victims of a hate crime or go missing. This survey will help ensure that the transgender community's opinions are taken into consideration regarding how the transgender community views HRT and to learn about their experience if they have or are looking to undergo HRT in their transition process.

6. **What will be done during this research study?**

There will only be one survey that you will be asked to complete, and it will take around 15 – 30 minutes to complete.

7. **How will my data be stored or shared?**

This study involves the collection of private information (name, dates, etc.). Even if identifiers (name, dates, etc.) are removed, information collected as part of the research will not be used or distributed for future research studies.

8. **What are the possible risks of being in this research study?**

We will do our best to protect your data during storage. However, there remains a possibility that someone could identify you. There is also the possibility that unauthorized people might access your data. In either case, we cannot reduce the risk to zero.

9. **What are the possible benefits to you?**

You are not expected to get any benefit from being in this study.

10. **What are the possible benefits to other people?**

The benefits to science and/or society may include helping create standards in forensic anthropology that currently do not exist to identify transgender individuals who may have been the victim of a hate crime or have gone missing.

11. **What are the alternatives to being in this research study?**

Instead of being in this research study you can choose not to participate.

12. **What will being in this research study cost you?**

There is no cost to you to be in this research study.

13. **Will you be compensated for being in this research study?**

We will not pay you to take part in this study or pay for any out-of-pocket expenses related to your participation, such as travel costs.

14. **What should you do if you have a problem during this research study?**

Your welfare is the major concern of every member of the research team. If you have a problem as a direct result of being in this study, you should immediately contact one of the people listed at the beginning of this consent form.

15. **How will information about you be protected?**

Reasonable steps will be taken to protect your privacy and the confidentiality of your study data.

The research records will be securely stored electronically through a University approved method and will only be seen by the research team and/or those authorized to view, access, or use the records during and after the study.

Those who will have access to your research records are the study personnel, the Institutional Review Board (IRB), and any other person, agency, or sponsor as required by law or institutional responsibility. Information from this study may be published in scientific journals or presented at scientific meetings and may be reported individually, or as group or summarized data but your identity will be kept strictly confidential.

16. **What are your rights as a research subject?**

You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study.

For study related questions, please contact the investigator(s) listed at the beginning of this form.

For questions concerning your rights or complaints about the research contact the Institutional Review Board (IRB):

- Phone: 1(402)472-6965
- Email: irb@unl.edu

17. **What will happen if you decide not to be in this research study or decide to stop participating once you start?**

You can decide not to be in this research study, or you can stop being in this research study ("withdraw") at any time before, during, or after the research begins for any reason. Deciding not to be in this research study or deciding to withdraw will not affect your relationship with the investigator or with the University of Nebraska-Lincoln.

You will not lose any benefits to which you are entitled.

Documentation of informed consent

You are voluntarily making a decision whether or not to be in this research study. By clicking on the I Agree button below, your consent to participate is implied. You should print or save a copy of this page for your records.

I agree

I do not agree